Sulfonated Poly(ionic liquid) Block Copolymers

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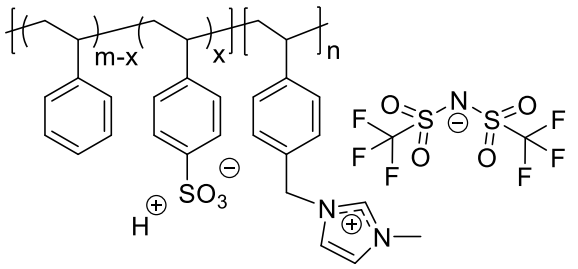
Poly(ionic liquid) block copolymers (PILBCPs) (where one block contains ionic liquid (IL) chemistry) have been investigated as lithium ion conducting solid polymer electrolytes for batteries and hydroxide conducting membranes and ionomers for alkaline fuel cells,[1] while sulfonated block copolymers (where one block contains sulfonic acid) have been intensively explored as proton conducting membranes and ionomers for proton exchange membrane fuel cells.[2] Conjoining these two materials into one, *i.e.*, sulfonated PILBCPs, where one block contains IL chemistry and the other contains sulfonic acid, is of significant interest to provide a new material platform with desired properties including high proton conductivity (from the sulfonated polymer) and IL-philicity (from the PIL). To date, the synthesis of sulfonated PILBCPs still remains an unexplored area of research. In this work, a sulfonated PILBCP consisting of a styrene-based sulfonic acid block with mobile protons (H^+) and a styrene-based PIL block with mobile $TFSI^-$ anions was successfully synthesized *via* reversible addition-fragmentation chain transfer (RAFT) polymerization, followed by post-functionalization, anion exchange metathesis, and sulfonation. Three compositions were chosen to investigate the influence of the PIL block volume fraction on the chemical, thermal, and physical properties, and ion conductivity of the sulfonated PILBCPs. The influence of the IL incorporation on proton and water transport of the polymers and the nanostructured morphology was also explored in this work.



1. Meek, K. M.; Elabd, Y. A., Polymerized ionic liquid block copolymers for electrochemical energy. *J Mater Chem A* **2015,** *3* (48), 24187-24194.
2. Elabd, Y. A.; Hickner, M. A., Block Copolymers for Fuel Cells. *Macromolecules* **2011,** *44* (1), 1-11.